

**MAHARAJA GANGA SINGH UNIVERSITY
BIKANER
SYLLABUS**

**SCHEME OF EXAMINATION AND
COURSES OF STUDY**

FACULTY OF SCIENCE



M.Sc. BOTANY

M.Sc. PREVIOUS EXAMINATION – 2022

M.Sc. FINAL EXAMINATION - 2023

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FACULTY OF SCIENCE M.Sc. BOTANY
M.Sc. PREVIOUS BOTANY—2021-22

Total Marks of M. Sc. Previous = 450 Four papers of three hours duration.
Maximum Marks of each paper = 75 Minimum Passing Marks of each Paper= 19
Total Passing Marks of all four papers = 108 Max. Marks of Practical =150
I Practical include Paper-I and IV of Maximum 75 marks Minimum Passing Marks=27

II Practical include Paper-II and III of Maximum 75 marks Minimum Passing Marks=27

Duration of each practical = 5 hours Pattern of Theory Paper

Each paper is divided into 3 Sections

Section A :- Consists of 10 compulsory Questions of 2 (two) marks each.

Word limits: Max 50 words.

Selection of question of Examiner- Maximum 2 from each unit (10X2=20)

Section B :- Consists of 5 Questions of 5 (five) marks each with internal choice.

Students are required to

Attempt all five questions. Word limits: Max 200 words.

Selection of question of Examiner- Maximum 2 from each unit (5X5=25)

Section C :- Consists of 5 Essay type Questions of 10 (ten) marks each.

Students are required to Attempt any 3 questions.

Word limits: Max 500 words. Selection of question of Examiner-

Maximum one from each unit (3X10=30)

**PAPER I : MICROBIOLOGY, PHYCOLOGY, MYCOLOGY AND
PLANT PATHOLOGY**

3 Hrs.

75

Marks

Unit- I

Microbiology: Archaeobacteria and Eubacteria : General account, ultra structure, nutrition and reproduction, biology and economic importance. Cyano bacteria: Salient features and biological importance.

Viruses: Characteristics and ultra structure of virions, chemical nature, replication, transmission of viruses, economic importance. Phytoplasma: general characteristics and role in causing plant diseases.

General account of immunity, types of immunity, allergy and types of allergies, properties of antigens and antibodies, serology, types of vaccines.

Unit- II

Phycology: Algae in diversified habitats (terrestrial, fresh water, marine); Range of thallus organization, cell structure, reproduction, sexuality in Algae. Criteria for classification of Algae; pigments, reserve food, flagella, classification, salient features of Protochlorophyta, Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, Phaeophyta and Rhodophyta with reference to following genera:—
Cyanophyta—*Anabaena*, *Rivularia*

Chlorophyta – *Gonium*, *Nitella*, *Bulbochaete*, *Closterium*, *Acetabularia*.

Xanthophyta—*Botrydium*. Bacillariophyta—*Cyclotella*, *Navicula*. Phaeophyta—

Padina, *Sargassum*.

Rhodophyta –*Liagora*, *Ceramium*.

Unit- III

General characteristics of Euglenophyta, Dinophyta, Chrysophyta and Cryptophyta. Nitrogen fixation in Algae, algal biofertilizers, algal blooms, fossil algae, algae as food, feed and uses in industry.

Mycology: Present criteria used in classification of fungi with reference to vegetative and reproductive structures. Comparative study of following divisions and subdivisions:

Plasmodiogymnomycotina: *Stemonities*, *Physarum* Haplomastigomycotina:

Synchytrium, *Plasmodiopora* Diplomastigomycotina: *Peronospora*, *Plasmopara*

Zygomycotina: *Syncephalastrum*, *Piloboulus*

Unit- VI Ascomycotina: *Taphrina*, *Phyllactinia*,

Chaetomium Basidiomycotina: *Puccinia*, *Melampsora*, *Ustilago* Deuteromycotina:

Fusarium, *Cercospora*, *Colletotrichum*

Heterothallism, Heterokaryosis, Parasexual cycle

Role of fungi in industries with reference to production of alcohol, organic acids, antibiotics, food and fodder. Mushroom cultivation, Mycorrhiza application in agriculture and plant growth.

Plant Pathology: Symptomatology and identification of diseases with reference to fungal, bacterial and viral infections.

Unit- V

Etiology and control of the following crop diseases:- Paddy: Blast, Bacterial leaf blight, Tungro virus Wheat: Bunt., Tundu disease

Bajra: Ergot and Smut Sugarcane: Red rot

Potato: Early blight, Virus-X, Y Cotton: Angular leaf spot

Grapes: Downy mildew, Powdery mildew Groundnut: Tikka

Tomato: Tomato Mosaic Virus

Disease control by physical, chemical and biological methods, resistant varieties, crop rotations, plant quarantine.

Reference Books-

1. An introduction to Algae – Morris, Cambridge Univ. Press U.K.
2. Introductory Phycology – H.D. Kumar, Affiliated East West Press Ltd., New Delhi.
3. Phycotalk Vol. I and II - H. D. Kumar Rastogi Publ., Meerut.
4. Recent Advances in Phycology - H.D. Kumar Rastogi Publ., Meerut.
5. Aquatic Biology in India - Kachroo P. Bishan S. Mahendra Pal. Dehradun
6. The structure and reproduction in the Algae –Vol. I & II , F.E. Fritsch, Cambridge Univ. Press.
7. Cryptogamic Botany –Vol. I , G.M. Smith, Tata Mac Graw Hill Publication, New Delhi
8. Advances in Phycology— edited by B.N. Verma, APC Publication India.
9. Phaeophyceae in India –J.N. Mishra, ICAR Publication, New Delhi.
10. Sea weeds and their uses –V.J. Chapman
11. Introductory Mycology – Alexopolus, John Wiley and Sons Ind.
12. An Introduction to Mycology – Mehrotra and Aneja, New Age Intermediate Press.
13. Diseases of India – Rangaswami and Mahadevan, Prentice Hall of India Pvt. Ltd., New Delhi.

14. Introduction to Fungi – Webster, Cambridge Univ. Press.
15. Plant Diseases - R.S. Singh, Oxford and IBH Publishing.
16. Plant Pathology – Agrios, Academic Press, London
17. Plant Pathology – Mehrotra, Tata McGraw Hill, New Delhi.
18. Microbiology and Pathology – P.D. Sharma, Rastogi Publication, Meerut
19. Fundamentals of Plant Pathology – V.N. Pathak Agro Botanica, Jodhpur.
20. Microbiology and Pathology – S.S. Purohit, Agro Bot. Jodhpur.
21. Microbiology – Palezar, Chand and King, McGraw Hills, London.
22. A text book of modern Plant Pathology – Bilgrami and Dubey, Vikas Publication, New Delhi.

**PAPER II : BRYOLOGY, PTERIDOLOGY AND
GYMNOSPERMS**

3 Hrs.

75 Marks

Unit- I

Bryophytes: Origin of Bryophytes (including fossil record), primitive versus advanced features, evolutionary lines, classification, comparative study of gametophytes and sporophytes of Takakiales, Calobryales, Jungermanniales, Sphaerocarpaceae, Marchantiales, Anthocerotales, Sphagnales, Andreales and Bryales with reference to following genera: *Takakia*, *Calobryum*, *Fossombronia*, *Pellia*, *Sphaerocarpus Monoclea*, *Dumortiera*, *Targionea*, *Asterella*, *Notothylas*, *Anthoceros*, *Sphagnum*, *Andreaea*, *Busxbaumia*.

Unit- II

Economic importance of Bryophytes with special reference to Ecology, pollution indicators and monitoring geobotanical prospects. Pteridophytes: Life cycle with reference to alternation of generation, colonization of terrestrial environment, soral evolution. Apomictic life cycle: Apogamy, apospory, vegetative apomixis. Evolution of stele, Heterospory and seed habit..

Systematic, Reproduction and Phylogeny of the following: Rhyniopsida- *Rhynia*, *Horneophyton*

Zosterophylloids - *Zosterophyllum*

Trimerophytopsida – *Psilophyton*

Unit- III

Systematic, Reproduction and Phylogeny of the following: Psilopsida- *Tmesipteris*

Lycopodiopsida- *Isoetes*, *Lepidodendron* Sphenopsida- *Sphenophyllum* Pteropsida-

Ophioglossum Osmundales - *Osmunda* Gleicheniales- *Gleichenia*

Polypodiales- General account Salviniales – *Salvinia*, *Azolla*

Unit- IV

Gymnosperms: Introduction, classification of Gymnosperms. Morphology, anatomy, reproduction and interrelationship of: Pteridospermales – *Glossopteris*

Bennettitales – *Cycadioidea*, *Williamsonia* Pentoxylales – General account

Ginkgoales – *Ginkgo*

Unit- V

Coniferales – General account Taxales – *Taxus*, Welwitschiales – *Welwitschia*

Gnetales – *Gnetum*

Distribution of living and fossil Gymnosperm in India. Origin & evolution of Gymnosperms. Geological time scale.

Reference Books-

1. Economic importance of gymnosperms Bryophyta – N.S.Parihar, Central Book Depot, Allahabad
2. Bryophyta – N.S. Parihar, Central Book Depot, Allahabad.
3. Biology and Morphology of Pteridophytes, N.S. Parihar ,Central Book Depot, Allahabad.
4. Bryophytes – P. Puri , Atma Ram & Sons, Delhi.
5. The Morphology of Pteridophytes – Sporne, B.I. Publishing Pvt.Ltd. Bombay.
6. Paleobotany and the evolution of Plants – Stewart and RothWell, Cambridge Univ. Press.
7. Gymnosperms – Bhatnagar and Moitra, New AgeInternational Pvt. Ltd., New Delhi.
8. Gymnosperms – O.P. Sharma, Pragati Prakshan, Meerut.
9. The interrelationships of the Bryophyta-Frank Cavers, Folkestone, Kent England.
10. Morphology of Gymnosperme – Coulter and Chamberlain,Central Book Depot., Allahabad.
11. Gymnosperms Structure and Evolution - C.J. ChamberlainDover Pub., New York.
12. Cryptogamic Botany Vo. I and II - Smith McGraw Hill BookComp., New York.
13. An introduction to Pteridophyta -A. Rashid, Vikas Publ. House,New Delhi.
14. Paleobotany and Plant evolution- Iqbal Hussain ABD Publ.Jaipur.

PAPER III: ECOLOGY, PHYTOGEOGRAPHY,
ETHNOBOTANY AND ECONOMIC BOTANY

3Hrs.

75 Marks.

Unit- I

Ecology: Definition and scope, concept of habitat and ecological niches. Composition and structure of an ecosystem, plant succession, energy flow, food chain, food web and trophic levels, ecological pyramids and recycling of N, P, C and S cycles in nature.

Unit- II

Sources, causes and control of air, water, soil noise pollution. Effect of environmental pollution on plants, animals and human beings. Environmental impact assessment (EIA).

Brief account of the following: Afforestation and people's involvement, Social Forestry, Agroforestry, Silviculture, Wind Break. International Biological Programme (IBP). Man and Biosphere (MAB). International Union for Conservation of Nature and Natural Resources (IUCN), United Nations Environmental Programme (UNEP), Wild life resources, Endangered plants and their conservation . Nature Resources, National Parks, Wild Life Sanctuaries. Biosphere Reserves. Green Belt. Wild Life Preservation Act (1972) and Indian Forest Conservation Act.(1980).

Unit- III

Phytogeography: Plant dispersal and migration. Continuous and discontinuous distribution of plants and geographical barriers. Types and areas of natural distribution, factors affecting distribution, main habitat and vegetation types of the

world. Major type of biomes and their characteristics, classification of vegetation of India and Rajasthan.

Ethnobotany: Aims, objective and scope. Methods of study of ethnobotany. Ethnobotany of Rajasthan and India. Ethnic groups of Rajasthan, major tribes and their life styles. Shifting cultivation and consequential damage to forest ecosystem.

Unit- IV

Economic Botany: Centers of origin of cultivated plants and gene diversity utilization of cereals, cultivation and improvement of Wheat, Rice, Maize, Bajra.

Pulses and forage legumes – a general account

Oil seeds – Mustard, Sesame, Groundnut, Soybean, Sunflower
Fiber- Cotton, jute, Coir

Starch and Sugar- Potato, Sugarcane, Sugar beet

Species and Condiments- Cinnamomum, Clove, Fennel, Cumin, Coriander, Saffron, Cardamom, Fenugreek, Akarkara.

Unit- V

Industrial Plant: Gwar, Rubber, Tea, Coffee
Narcotics: Cannabis, Opium, Tobacco

General account of local plants of medicinal importance along with

Digitalis, *Terminalia*, *Commiphora*, *Ocimum*, *Convolvulus* (Sankh Pushpi),

Catharanthus roseus, *Aloe*, *Centella* (Brahmi Booti), *Chlorophytum*

(Safed musli), *Tylophora indica*. Unexploited Plants of Potential Economic Value with reference to Rajasthan.

Reference Books-

1. Concepts in Indian Ecology - David N. Sen, Vishal Publishing Co., Jalandhar.
2. Ecology and Field Biology - R.L. Smith, Harper Collins, New York
3. Fundamentals of Ecology - Odum, Saunders, Philadelphia
4. Basic Ecology— Odum, Saunders, Philadelphia
5. Ecology, Principles and Applications Chapman and Reiss, Cambridge Univ. Press, Cambridge, U.K.
6. Concepts of Ecology - Kermondy, Prentice Hall of India Pvt. Ltd., New Delhi.
7. Modern Concepts of Ecology - H.D. Kumar, Vikas Publishing House.
8. Aims and Methods of Vegetation Ecology- Muller Dombois and Ellenberg.
9. Economic Botany- Hill, Mac Graw Hill Book Comp.
10. Economic Botany- Pandey, S. Chand and Com., New Delhi.
11. Ecology- Ambushta, CBS Publication.
12. Global Environmental agreements- Asha Joshi, Gunilla Reisch Pub.
13. Forest Ecology in India- Neena Ambre, Foundation Books.

PAPER-IV: BIOCHEMISTRY AND PLANT PHYSIOLOGY

3 Hrs.

75 Marks

Unit-I

Biochemistry : Carbohydrates : Classification, occurrence, structure and functions of monosaccharides, oligosaccharides, polysaccharides including starch, cellulose, pectin and chitin.

Proteins : Occurrence, structure-primary, secondary, tertiary and quaternary, properties and functions.

Lipids : Structure, synthesis of saturated and unsaturated fatty acids, lipid biosynthesis , á and â oxidations.

Enzymes : Structure, classification and mode of action.

Unit-II

Secondary metabolites : Definition, distribution and classification. Biosynthesis and functions of secondary metabolites with special reference to alkaloids, tannins and steroidal compounds.

Physiology : Water relations of plants : Unique physicochemical properties of water, solute potential , water potential in the plant, apparent free space, bulk movement of water. Soil Plant Atmosphere Continuum (SPAC). Stomatal regulation of transpiration, anti transpirants, internal water deficit and its physiological implications.

Unit-III

Uptake of minerals : Active and passive uptake of minerals, Donnan's equilibrium, Cytochrome pump mechanism and carrier hypothesis, role of calmodulin. Importance of foliar nutrition and use of chelates.

Photosynthesis : Energy pathway in photosynthesis, chloroplast as an energy transducing organelle, composition and characterization of photosystems I and II, electron flow through cyclic , non cyclic and pseudocyclic photophosphorylations , pathway of CO₂ fixation, difference between C3 and C4 photosynthesis, different kinds of C4 pathways, CAM pathway, regulation of photorespiration.

Unit -IV

Respiration : Concepts of free energy and entropy. Types of respiratory substrates and their utilization in respiration. Glycolysis and TCA cycle with emphasis on enzyme system, ATP synthesis through oxidative electron-transfer chain (cytochrome system), Chemo-osmotic regeneration of ATP, glyoxalate cycle.

Nitrogen Metabolism : Sources of nitrogen to plants. Biological nitrogen fixation, reduction of nitrates, synthesis of amino acids by reductive and transamination, Glutamate Oxaloacetate Transaminase (GOT) and Glutamate Pyruvate Transaminase (GPT) system.

Unit- V

Growth Regulators : Auxins, Gibberellins, Cytokinins , Abscissic acid and ethylene, their chemical nature, biosynthesis, bioassay, physiological effects and mode of action.

Physiology of Flowering : Photoperiodism and Vernalization.

Reference Books-

1. Introduction to Plant Physiology - Hopkins, John Wiley and Sons, New York, USA.
2. Plant Physiology. Salisbury and Ross, Wadsworth Publ. Co., California, USA.
3. Plant metabolism Dennis, Turpin, Lefebure and Layzell, Longman Essex, England.
4. Plant Physiology Taiz and Zeiger, Sinauer Associates, Inc Pub. Massachusetts, USA.
5. Biochemistry and Physiology of Plant Hormones Moore, Springer Verlag, New York, U.S.A.
6. Biochemistry. Lubert Stryer, W.H. Freeman and Comp., New York.
7. Plant Physiology, Devlin. Yan Nostrand Reinhold Comp. New York. Affiliated East West Press Pvt. Ltd., New Delhi.
8. Plant Physiology C.P. Malik, Kalyani Publishers, New Delhi.

9. A Text book of Plant Physiology and Biochemistry S.K. Verma, S.Chand & Comp., New Delhi.
10. Physiology of Plant Growth and Development Edited M.B. Wilkins McGraw Hill, London.
11. Plant Biochemistry - Bonner and Varner, Academic Press, New York.
12. Introduction to Plant Physiology - G.R. Noogle & G.J. Fritz Prentice Hall of India Pvt. Ltd., New Delhi.
13. Introduction to Plant Physiology. Mayer, Anderson, Bohning, Frantianne D. Van Nostrand Camp.
14. Biochemistry –Lehringer, Freeman & Co. Ltd.
15. Biochemistry –A.K. Bery,
Plant Biochemistry –edited P.M. Dey J.B. Harborne, Academic Press, New York.

Practical Marking Scheme

I Practical (Paper-I and IV)

Time 5 hours	Max. Marks 75
1. Phycology	6
2. Mycology	6
3. Plant Pathology	5
4. Microbiology	4
5. Plant Physiology	10
6. Plant Biochemistry	8
7. Spot (6) three-Paper-I; three-Paper-IV	12
8. <i>Viva-voce</i>	8
9. Records	8
10. Excursion Report	8
Total	75

II Practical (Paper-II and III)

Time 5 hours	Max. Marks 75
1. Gymnosperms	10
2. Pteridophytes	6
3. Bryophytes	6
4. Ecology (Field study-Quantitative and Analytical characters)	10
5. Ecological Anatomy-Adaptation	6
6. Phytogeography (India/world)	5
7. Economic Botany	4
8. Spot (6) three-Paper-II; three-Paper-III	12
9. <i>Viva-voce</i>	8
10. Records	8
Total	75

M.Sc. FINAL BOTANY—2022-23

Scheme

Total marks of M.Sc. Final

= 450

Four papers of three hours duration (2 compulsory+2 special). Maximum marks of each paper = 75

Minimum Passing Marks of each paper = 19 Total Passing Marks of all four papers= 108 Maximum marks of Practical = 150

I Practical include Paper-V and VI of maximum 75 marks (Compulsory) Minimum Passing Marks= 27

II Practical include Paper-VII and VIII of maximum 75 Marks (special) Minimum Passing Marks= 27

II Practical include 20 marks of PROJECT/DESSERTATION

Duration of each practical = 5 hours

Pattern of Theory Paper Each paper is divided into 3 sections

Section A :- Consists of 10 compulsory Questions of 2 (two) Mark each.

Word limits Max 50 words.

Selection of question of Examiner- Maximum 2 from each unit (10X2=20)

Section B :- Consists of 5 Questions of 5 (five) mark each with internal choice. Students are required to Attempt all five questions.

Word limits Max 200 words.

Selection of question of Examiner- Maximum 2 from each unit (5X5=25)

Section C :- Consists of 5 Essay type Questions of 10 (ten)marks each. Students are required to

Attempt any 3 questions. Word limits Max 500 words.

Selection of question of Examiner- Maximum one from each unit (3X10=30)

COMPULSORY PAPERS

Paper V: Angiosperms: Taxonomy, Mophology, Anatomy and Embryology Paper VI: Molecular Biology, Biotechnology, Genetics, Plant Breeding and Biometrics

SPECIAL PAPERS

Paper VII : (a) Advanced Plant Pathology I

Paper VIII : (a) Advanced Plant Pathology II

Paper VII	:	(b)	Advanced Plant Ecology I
Paper VIII	:	(b)	Advanced Plant Ecology II
Paper VII	:	(c)	Advanced Plant Physiology I
Paper VIII	:	(c)	Advanced Plant Physiology II
Paper VII	:	(d)	Advanced Plant Biotechnology I
Paper VIII	:	(d)	Advanced Plant Biotechnology II

PAPER V : ANGIOSPERM TAXONOMY, MORPHOLOGY, ANATOMY
AND
EMBRYOLOGY

3 Hrs.

75 Marks

UNIT – I

Taxonomy: Botanical exploration: B.S.I., its organization and role, modern tools of plant taxonomy.

Systems of plants classification: Bentham and Hooker, Cronquist, Takhtajan and Thorne. Phylogeny of angiosperm. Origin, evolution and inter-relationships in dicots and monocots.

UNIT- II

Phylogeny of Ranales, Amentiferae, Centrospermae, Tubiflorae, and Helobiales. Families of heterotrophic nature (parasitic, saprophytic and insectivorous.) **Botanical nomenclature:** ICBN rules, articles, recommendations and amendments of code. **Botanical literature:** Monographs, Icones, floras and important periodicals with emphasis on Indian floristics.

UNIT – III

Morphology : General concept of plant morphology: Origin and evolution of flower. **Stamen-** Origin and evolution from foliar to reduced condition, extension of connective beyond anthers, mono di polyadelphous, nectaries and nectar. **Carpel evolution :** Conduplicate, involute, appendicular and receptacular concepts, specialized carpels, poly and syncarpy, semi-inferior and inferior ovary. Evolution and types of placentation. Role of floral anatomy in interpreting the origin and evolution of flower and floral parts.

Anatomy: Ultrastructure and functions of primary and secondary xylem. Ultra structure and function of phloem. Structural variability in leaves and trichomes. Anatomy of dicotyledonous and monocotyledonous seeds.

UNIT- IV

Embryology: Microsporangium, structure and function of wall layers, ultra functional changes in tapetum and meiocytes, role of callose, role of tapetum in pollen development, development of male gametophyte. Anther culture and haploid plants. Megasporangium (ovule) – types and evolution, megasporogenesis, embryosac types, structure of egg, synergids, antipodal cells.

Pollination: structure and histochemical details of style and stigma. Self and interspecific incompatibility. Barriers to fertilization, methods of overcoming incompatibilities. In-vitro pollination and its uses.

UNIT- V

Fertilization: discharge and movement of sperms, syngamy and triple fusion, post fertilization changes in embryo sac. Endosperm: Development types, haustoria, cytology and function of endosperm. Embryo : embryogenic types and embryo culture. Polyembryony: types, natural, induced, importance.

Apomixis : Type and importance. Role of embryology in plant breeding.

Reference Books-

- 1 Diversity and classification of Flowering Plants- Takhtajan, Columbia Univ. Press, New York.
- 2 An introduction to Embryology of Angiosperm - P. Maheshwari, New Delhi.
- 3 Recent Advances in the Embryology of Angiosperms-P. Maheshwari, New Delhi.
- 4 The embryology of Angiosperms - Bhajwani and Bhatnagar, Vikas Pub. House, New Delhi.
- 5 Taxonomy of Angiosperms - V.N. Nair, TMH Publishing Comp. Ltd., New Delhi.
- 6 Taxonomy of Angiosperms - Kshetrapal and Tyagi, RBD Pub., Jaipur.
- 7 Introduction to Principles of Plant Taxonomy-Sivarajan, Oxford & IBH Publishing Co., New Delhi.
- 8 Plant Systematics - Gurcharan Singh, Oxford & IBH Publishing Co. New Delhi.
- 9 Morphology of Vascular Plants - A.J. Eames, Tata McGraw Hill Publ. Co. Ltd., New Delhi.
- 10 An introduction to Taxonomy of Angiosperms - Shukla and Mishra, Vikas Publ. House Pvt. Ltd., New Delhi.
- 11 Modern Plant Taxonomy- N.S. Subramanyam, Vikas Publ. House Pvt. Ltd., New Delhi.
- 12 Morphology of Angiosperms -A J Eames, McGraw Hill Book Comp. Ltd., New York.
- 13 The Morphology of Angiosperms - Sporne, K.P. Churamani for B.I. Publications, New Delhi.
- 14 Morphology of Vascular Plants-D.W. Bierhorst Macmillan Comp., New York.
- 15 Morphology of Angiosperms - A.J. Eames, Mc Graw Hill Book Comp., New York.

PAPER VI: MOLECULAR BIOLOGY, GENETICS, BIOTECHNOLOGY, PLANT BREEDING AND BIOMETRY

3 Hrs.

75 Marks

UNIT-I

Molecular Biology: The discovery of DNA, evidences indicating DNA as the genetic material, DNA and its types (A, B and Z DNA), closed super coiled DNA, denaturing and renaturing of DNA, hybridization. DNA Replication: mechanism, enzymes, evidences in favour of semi conservative replication.

RNA: Structures, types, transcription, control at initiation , control at termination, attenuation, heterogeneous RNA processing, capping and tailing. Techniques employed in recombinant DNA technology, isolation and purification of DNA gel electrophoresis (Gel, Agarose), DNA sequencing, Southern and Northern blotting, PCR and its application.

UNIT- II

Gene structure and function , lac operon, tryptophan operon. Genetics: Mendelism

versus meiosis: Mendel's inheritance, Genes and their interaction, Polygenic-inheritance. Cytoplasmic inheritance, Sex determination-XXX. Linkage , crossing over chromosomal mapping, Polyploidy and its role in evolution. Mutation -types, chemical and physical mutagens.

UNIT- III

Biotechnology : concept and scope of biotechnology, Plant tissue-culture, anther and pollen culture, callus-culture and protoplast culture: Isolation, purification, culture and fusion: Cybrids and hybrids, Biotransformation; Production of useful compounds through cell-culture vectors; plasmids and cosmids, cloning strategies. Basic concepts about C-DNA , gene and genomic-library. Application of recombinant DNA technology . Genetic engineering and its principles, gene -transfer. Transgenic plants and methods, production , application and use, importance of genetic engineering.

UNIT- IV

Plant breeding: Introduction, Breeding methods in self and cross pollinated and vegetatively propagated crops. Polyploids and mutations and their uses in breeding. Characterization of polyploids and mutants, uses in plant breeding . Heterosis and inbreeding depression and causes of hybrid vigour. Production and application of hybrid vigour in plant breeding.

UNIT- V

Biometry: Mean, Mode & Median, standard deviation and SB experimental errors, hypothesis testing, reliability and validity of results and inferences from experiments. Variance, Standard deviation , co-efficient of variation, skewness and kurtosis. Probability distribution binomial, positive negative binomial. Chi square test hypothesis. Correlation : simple partial and multiple correlation, concept and uses.

Reference Books-

1. Molecular Biology of the Cell-Albert, Lewis, Raff, Robert and Watson, Garland Publishing Inc., New York.
2. Gene VII - Lewis, Oxford Univ. Press, New York, USA.
3. Genetics - Russel, The Benjamin Publ. Comp. Ltd., USA.
4. Cell and Molecular Biology - P.K. Gupta, Rastogi Publications, Meerut.
5. Molecular Biology of the Gene - J.D. Wastson,
6. Cell Biology and Genetics K.C. Agarwal, Nidhi Publisher, Bikaner.
7. Molecular Biology and Biotechnology, Nidhi Publisher, Bikaner
8. Principles of Cell and Molecular Biology- Klein Smith Harper Collins College Publ., New York, USA.
9. Molecular Cell Biology- Lodish, Berk, Zipursky, Matsudaira, Baltimore and Darnell, Freeman and Co., New York, USA.
10. Methods in Plant Molecular Biology and Biotechnology, CRC Press, Boca Raton, Florida.
11. Plant Cell Biology : Structure and Function – Gunning and Steer, Jones and Barlett Publ. Boston, Massachusetts.
12. Plants tissue Culture-Bhojwani and Rajdan. Theory and practice. Elsevier Science Publ., New York, USA.
13. Plant Tissue Culture : Applications and limitations-Elsevier Sci. Publ., New York, USA.
14. Plant Cell and Tissue Culture-Vasil and Thorpe, Kluwer Academic Publishers, Netherland.
15. Genetics- A.M. Winchester, Oxford and IBH Publishing Co. New Delhi.

16. Cell and Molecular Biology- De Robertis (Indian Edition) VergheseComp., Bombay.
17. Elements of Biotechnology – P.K. Gupta, Rastogi Publication, Meerut.
18. Plant Breeding -V.L Chopra,Oxford& BH Pub. Co. Pvt. Ltd.
19. Elementary principles of Plant Breeding - H .K. Chaudhary , Oxford &IBH Pub. Co. Pvt. Ltd.

PAPER VII a : ADVANCED PLANT PATHOLOGY - I

3 Hrs.

75 Marks

UNIT- I

Principles: History of plants pathology, The nature, origin and evolution of parasitism. Interaction of pathogen, soil, other soil micro organism and the host. Biotrophic parasites in culture. Role of plant tissue culture in studies on host parasite relationship. Phenomenon of plant infection, penetration, infection, post infection development, factors affecting infection, defence mechanism.

UNIT- II

Host pathogen interaction: The response of the host, pathogenicity and virulence, host specific toxins in relation to pathogenesis and disease resistance, hypersensitivity reactions. Nucleic acids in host parasitic interaction, phytoalexins, Inoculum potential, epiphytotic and disease forecasting.

Methods: Techniques of isolation, purification, culture and inoculation of pathogens. Techniques of tissue culture and its application in plant pathology. Raising virus free plants in culture.

UNIT- III

Histopathology: Calibration of microscopes and measurements. Use of electron microscope in histopathological investigations. Plant disease control: Physical control, chemical control, plant quarantines. Plant disease resistance and breeding of resistance varieties. Seed transmission diseases, factors affecting transmission of seed borne pathogens, control of seed borne diseases and types of seed treatments (physical , chemical and biological). Testing of efficacy of fungicides.

UNIT- IV

Fungi Diseases: Symptomatology and disease identification.

Some important disease of cereals: Smuts, rusts, leaf blights, spots mildew, Karnal bunt and flag smut of wheat, covered smut and stripe disease of barley; Brown spot and blast of paddy, Brown spot, downy mildew and Drechslera (Heiminthosporium). Blights of Maize: ergot and smut of Bajra, leaf spots and smuts of jowar, green ear disease of Bajra.

UNIT- V

Other diseases: Red root and smut of sugarcane, fusarium wilt of cotton flax and pigeon pea; flax rust, Ascochyta blight of gram; early blight of tomato and potato; late blight of potato; Tikka disease of groundnut and downy and powdery mildew of grapes.

UNIT- I

Classification and nomenclature of bacterial pathogens. Symptomatology, Methods of identification of bacterial pathogens. (i) Morphology (ii) Physiology (iii) Serology (iv) Pathogenicity. Physiological and cytological aspects of bacterial infection process and disease development. Mechanism of infection of bacterial pathogens.

UNIT- II

Bacterial disease : Brown rot, ring rot of potato, Fire blight of stone fruits. Tundu disease of wheat, Stalk rots of maize. Bacterial blight of rice. Soft rot of vegetables. Red strip of sugarcane, Crown gall disease. Angular leaf spot of cotton, Citrus canker.

UNIT- III

Virology- Symptomatology, isolation, purification and culturing of viruses. Viral infection, nutrition, synthesis and replication. Transmission of viral disease. Mycoplasma, Acquired immunity, Interference and Synergism. Viral Diseases: Potato virus X and Y, Potato yellow dwarf

. Tomato mosaic and Tomato ring mosaic, Tobacco necrosis, Cucumber-mosaic, Bunchy top of Banana, Bhindi yellow mosaic.

UNIT- IV

Nematology: Classification and identification of plant pathogenic nematodes.

Morphology and anatomy of nematodes. Methods and use in nematology.

Nematode disease: Ear cockle of wheat, Root knot of vegetables, Moly disease of wheat.

UNIT- V

Non parasitic diseases: Disease due to deficiency of Nitrogen. Zinc, Boron and Oxygen, Ozone, PAN (peroxy acetyl nitrate), SO₂, Sulphur and Hydrogen fluoride.

Cecidology: Classification and anatomy of galls. Some insect induced plant galls of Rajasthan (Pongamia leaf gall, Cordial leaf gall, Ziziphus stem gall, Prosopis stem gall) mechanism and physiology of insect galls.

Reference Books –

1. Diseases of India – Rangaswami and Mahadevan, Prentice Hall of India Pvt. Ltd., New Delhi.
2. Plant Diseases - R.S. Singh, Oxford and IBH Publishing.
3. Plant Pathology – Mehrotra, Tata McGraw Hill. UK.
4. Microbiology and Pathology – P.D. Sharma, Rastogi Publication, Meerut
5. Principles of seed pathology – V.K. Agarwal and J.B. Sissclair Vol. I & II. CBS Publishers and distributors.
6. Plant pathology – G. N. Agrios. Academic Press, London and New York.
7. Seed pathology – P. Neergaarde Vol. 1 & 2 .The Macmillan Press Ltd., London.
8. Vistas in seed biology –T. Singh and P.C. Trivedi Vol. 1 & 2 Prinwell, Jaipur and Hyderabad.
9. Seed pathology – D. Suranarayana , Vikas Publishing House Pvt. Ltd.
10. Plant pathology – Tar , Mac Millan , London.
11. Ad. Tritics in Plant Pathology , Vol. I, II, III –Horsfall and Dimond, Academic Press , London.
12. Plant diseases –David S. Ingram and Noel Robertson , Callins.
13. Plant Pathology concept and laboratory exercises –Robert N. Trigiana, CRC Press.
14. Host pathogen interaction in plant diseases –J.E. Vander Plank, Academic Press,

New York.

PAPER VII b : ADVANCED PLANT ECOLOGY – I

3 Hrs.

75 Marks

Unit- I

Fundamentals of Ecology, Definition, history and scope.

Environment : Holistic environment, factors (Climatic, Edaphic, Topographic and Biotic) and their interactions with plants. Population and community ecology. Succession in plant communities. Plant interaction with other organisms within community.

Unit- II

Ecosystem : concept, structure and function, flow of energy, Biogeochemical cycles, evolution of ecosystem, system analysis and its applications. Concept of ecosystem, resistance and resilience; natural and anthropogenic ecological perturbations and their impact on plants and ecosystems. Ecosystem restoration. Ecology of plant invasion. Ecological management; concept of sustainable development, sustainability indicators.

Unit- III

Types of Ecosystem: Forest, grassland, desert, fresh water, marine water, wetland, natural and man made ecosystems, urban and rural ecosystem.

Production ecology: Organic production in different types of ecosystems, process and magnitude of production, primary and secondary productivity and methods of estimations of productivity.

Unit- IV

Natural Resources: Types, exploitation and conservation (forest, soil, water, air and energy). Biodiversity of India, Hot spots, threats to biodiversity (endangered flora and fauna), biodiversity indices, biodiversity gradient, factors affecting species diversity , edge effect ,biodiversity –ecosystem stability relationship, conservation of biodiversity-*ex-situ* and *in-situ*. Introduction to world Biomes. Wild life protection act 1972, Forest Conservation Act 1980, Earth submit 1992.

Unit- V

Pollution : Air, Water, Soil, Noise, Thermal, Global warming and climatic change, effect of green house gases ;CO₂,CH₄ ,N₂O ,CFCs ,ozone layer and hole ,CBD (Convention on Biological Diversity) Role of international organizations (IUCN, UNEP, UNESCO). Red Data Book, Water Prevention and Control of Pollution Act 1974, Environmental Protection Act, 1986, Prevent and Control of Pollution Act 1981, Environmental Impact Assessment, Environment Education, Awareness and Ethics.

PAPER VIII b: ADVANCED PLANT ECOLOGY–II

3 Hrs. Duration

75 Marks

Unit - I

Desert, their formation, topography and distribution characteristics of desert with special reference to water economy. The hot and cold deserts and other similar habitats.

Unit - II

Introduction to World Desert Biome: Origin, characters and geomorphology of Thar Desert. Vegetation and floral composition of Rajasthan desert: Adaptations of plants and animals matching the desert environment. Effect of abiotic and biotic factors on

desert vegetation and distribution. Thar desert resources: forest energy, minerals, live stock and rangeland conditions.

Unit - III

Ecology of grazing land and impact of overgrazing, Threatened plants of Rajasthan desert and conservation strategies. Arid regions of India with particular reference to Rajasthan.

The saline tracts and their vegetation (Halophytes) with their reference to Rajasthan, Mangrove vegetation.

Unit - IV

Rajasthan - Geology, Physiography, Climate & Soil. Water problem in Rajasthan particularly underground water resources and its change. Desert as an ecosystem, biological productivity, cycles and balances in desert ecosystem.

Unit - V

Vegetation of Rajasthan desert and plant communities. Soil erosion and reclamation of soil, stabilization of sanddunes.

Habit studies and Phenology of the desert Plants. Root investigation, Reproduction Capacity: Seed output, Germination, Dormancy and Viability.

Reference books –

1. *Environment and Plant Life in Indian desert*, David N Sen, Department of Botany, University of Jodhpur, Jodhpur, India.
2. *Terrestrial plant ecology* – M.G. Barbour, J.H. Burk and W.D. Pitts, Benjamin/Cumming Publication Company, California.
3. *Ecology* – M. Begon, J.L. Harper and C.R. Townsend, Blackwell science, Cambridge.
4. *Population, environment and development* – R.K. Pachausri and L.F. Qureshy, Tyeri, New Delhi.
5. *Population biology of plants* – J.L. Harper, Academic press, London and New York.
6. *Introduction to plant ecology* – Maurice Ashby, Mac Millan Uni. of Wisconsin
7. *Readings in conservation ecology* – G.W. Cox, Appleton Century Crofts, Michigan.
8. *Plant ecology* – E. Weaver, Ecological Society of America.
9. *Forest ecology of India* – G.B. Singh, Rawat Publications.
10. *Ecology of natural resources* – Francois Ramade, John Wiley & Sons Ltd.
11. *Plants and environment* – Daubenmire,
12. *Environmental biology* – K.C. Agarwal, Agrobotanical Pub..
13. *Environmental pollution* – Timmy Katyal, Anmol Pub..
14. *Environment and pollution* – Ambasht, CBS Publications.
15. *Environmental pollution and health hazard in India* – R. Kumar, Anish publication home.

16. Indian forest ecology –G.S.Puri, Oxford IBH.

PAPER VII c : ADVANCED PLANT PHYSIOLOGY - I

3 Hrs. Duration

75 Marks

UNIT- I

Carbohydrates: Classification and synthesis:Respiration: Anaerobic, aerobic, pentose phosphate cycle (HMP) Photo respiration, fermentation, Photosynthesis: Pigments (Chlorophylls, carotenoids) structure, synthesis functions, polyamines, Photophosphorylation, Calvin cycle, C4 dicarboxylic acid cycle.

UNIT- II

Protein: Chemistry, Classification and synthesis. Enzymes: Classification,structure, mechanism of action inhibition, promotion, activation.

Water soluble pigments (anthocyanins) synthesis and function (Genetic role) .Nitrogen fixation, nitrogen and sulphur metabolism : Overview biological nitrogen fixation, nodule formation and nod factor mechanism of nitrate uptake and reduction.

Ammonium assimilation, sulphate uptake, transport andassimilation ,amino acid synthesis.

Lipid metabolism:Classification of fats and oils, saturated and unsaturatedfatty acids, fatty acid oxidation.

UNIT- III

Coumarins & lignins: Structure and synthesis, chemistry, distribution and function.

Vitamins: Structure and function. Metabolism of secondary metabolites : Tannins : Distribution, synthesis and functions. Hallucinogens: distribution , chemistry and functions, Alkaloids : pyrrole and pyrrolidine, pyridine, polyacetyl, isoquinoline , tropane and indole alkaloids, their distribution synthesis and function.

UNIT- IV

Saponins and saponogenins, sterols, steroids, steroid alkaloids, theirdistribution, synthesis and function .

Cardiac glycosides: structure and functions, Structure, synthesis & functionsof flavonoids.

UNIT- V

Tools and techniques :Principle and application of spectrophotometry, chromatography ,partition chromatography , thin layer chromatography, ion exchange chromatography, gas liquid chromatography,

high performance liquid chromatography, gel filtration ,electrophoresis, ultra-Centrifugation, isoelectric focusing , immobilized pH gradient , ELISA and RIA

PAPER VIII c : ADVANCED PLANT PHYSIOLOGY–II

3 Hrs. Duration

75 Marks

UNIT- I

Plant growth regulators: Auxins, discovery, structure, biosynthesis, mode ofaction and function.

Gibberellins- discovery, physiological effects, and response of plants,biosynthesis and mode of action.

Cytokinins- discovery, structure, biosynthesis, physiological effect on seedplants and mode of action.

UNIT- II

Synthetic growth retardants, their physiological effect and biochemistry.

Growth inhibitors- Abscessic acid and related compounds: discovery, natural occurrence, physiological effects, biosynthesis, mode of actions. Ethylene- History,

biological effects, biosynthesis, mode of actions.

UNIT-III

Role of Growth regulators on modern agriculture and horticulture. Brief account of brassinosteroids, polyamines, Jasmonic acid, salicylic acid and nitric oxide signaling in plant defence. Hormone mutants.

Phytochromes— History and discovery, occurrence and distribution of phytochromes, cryptochromes and phototropins, their photochemical and biochemical properties.

UNIT- IV

Photophysiology of light induced responses, cellular localization. Brief account of molecular mechanism of action of photomorphogenic receptors.

Photoperiodism, vernalization, chemical: control of flowering. Circadian rhythms in plants.

Seed germination and dormancy. Juvenility and senescence.

UNIT- V

Stress physiology :Plant responses to biotic and abiotic stress, plant defence mechanisms against water stress, salinity stress, metal toxicity, freezing and heat stress and oxidative stress. Photoinhibition and other physiological activities affected by stress. Role of plant hormones in plant response to stress (ABA and Polyamines). Photoinhibition and physiological activities affected by stress.

Reference book –

1. Introduction to plant physiology –W.G. Hopkins, John Wiley & Sons, Inc. New York USA.
2. Biochemistry and physiology of plant hormones –T.C. Moore, Springer and Verlag, New York, USA.
3. Plant physiology –L. Taiz and E. Zeiger, 2nd edition, Sinauer Associates, Inc. Publisher, Massachusetts, USA.
4. Plant physiology –F.B. Salisbury and C.W. Ross, 4th edition, Wadsworth publishing Co., California.
5. Photoperiodism in plants –B. Thomas and D. Vince, 2nd edition Academic press, Sandiego, USA.
6. Plant Physiology –S. Mukharji and A.K. Gosh
7. Plant Physiology –D. Hess, Springer Berlin.
8. Plant Physiology –F.C. Steward, Academic Press, New York.
9. Introduction to Plant Physiology - Hopkins, John Wiley and Sons, New York, USA.
10. Plant Physiology. Salisbury and Ross, Wadsworth Publ. Co., California, USA.
11. Plant metabolism Dennis, Turpin, Lefebure and Layzell, Longman Essex, England.
12. Plant Physiology Taiz and Zeiger, Sinauer Associates, Inc Pub. Massachusetts, USA.
13. Plant Physiology, Devlin. Yan Nostrand Reinhold Comp. New York. Affiliated East West Press Pvt. Ltd., New Delhi.
15. Plant Physiology C.P. Malik, Kalyani Publishers, New Delhi.
16. A Text book of Plant Physiology and Biochemistry S.K. Verma, S. Chand & Comp., New Delhi.
17. Physiology of Plant Growth and Development Edited M.B. Wilkins McGraw Hill, London.

PAPER VII d : ADVANCED PLANT BIOTECHNOLOGY- I

3 Hrs.

75 Marks

UNIT- I

Concept and scope of plant Biotechnology Plant tissue culture: A historical perspective. The phenomenon of morphogenesis, morphogenetic factors for in vitro regeneration. Organogenesis and somatic embryogenesis.

UNIT- II

Micro propagation technology, meristem culture, haploids, anther- pollen culture and their uses.

Management of micro propagated plants in laboratory and net houses. Commercial feasibility and advantages of micro propagation.

UNIT- III

Somatic embryogenesis- concepts, prospects and uses. Hybrid embryo rescue technique, production of rare hybrids, invitro pollination. Use of somatic embryogenesis in crop improvement.

UNIT- IV

Somatic hybridization and cybridization techniques and uses. Concepts about male sterility and their uses in crop improvement. Selection and characterization of mutant cell lines, auxotrophic mutants.

UNIT- V

Tissue culture as a source of genetic variability. Somaclonal variations, basic concepts and its applications. Protoplast production- concepts and applications. Role of plant biotechnology in crop improvement, horticulture, forestry and conservation of biodiversity.

PAPER VIII d : ADVANCED PLANT BIOTECHNOLOGY- II

3 Hrs. Duration

75 Marks

UNIT- I

Basic concept about recombinant DNA technology. Commonly used gene cloning vectors: plasmid, cosmids, phages. A brief account of YAC, BAC, HAC. Restriction: endo nucleases and other enzymes needed in genetic engineering.

UNIT- II

Gene transfer in plants, agro bacterium mediated gene transfer. Crown gall disease, the tumour inducing principle and Ti plasmid, incorporation of T- DNA into plant cells. Direct gene transfer methods for producing transgenic plants, DNA mediated transformation of protoplasts, electroporation, ballistic methods used for gene transfer. herbicide, insect resistance plants.

UNIT- III

Southern, Northern and Western blotting technique. PCR: its principles and uses. Gene concepts and molecular biology of gene. Transcription and translation in prokaryotes and eukaryotes. Nitrogen fixing and genes and their genetic manipulation.

UNIT- IV

Ant sense –RNA, principles and applications. Male sterility: types and uses. Molecular farming.

Secondary metabolites and strategies to increase their production in tissue culture.

UNIT-V

Biotechnology and society, socio-economic aspects. Uses of cloned genes in agriculture, medicine and industry. Transgenic plants: Production and applications. Plant biotechnology and Intellectual Property rights(IPR).

Reference Books –

1. Introduction to Biotechnology –W.J.Thieman and M. A. Palladino,Publisher Benjain Cummings.
2. Plant Biotechnology –Randheer Singh, ISBN.
3. Plant Biotechnology Methods in tissue culture and gene transfer –R.Keshav Chand & K.V.Peter,ISBN
4. Plant conservation Biotechnology –Ranjeet Kaur Bhalla, ISBN.
5. Plant Biotechnology and Biodiversity Conservation –U.Kumar & A.K.Kumar, Agrobios Jodhpur.
6. Advances in Applied Biotechnology –P.Parihar & L.Parihar, Agrobios,Jodhpur.
7. Text Book of Biotechnology –Preeti Gupta ,ISBN.
8. Introduction to Plant Biotechnology –H.S.Chawla, Amazon.
9. Recent Advances in Plant Biotechnology –A.Kirakosyan & P.B.Kaufman.
10. Biotechnology fundamentals and applications –S.S.Purohit, AgrobiosJodhpur.
11. Biotechnology –S.R. Barnum, Brooks Cole.
12. PlantBiotechnology-P.K.Gupta,Rastogi Publication Meerut.
13. Laboratory Manual of Biotechnology –P.K.Gupta, RastogiPublication Meerut.

Practical marking scheme

I Practical (Paper-V and VI)

Time 5 hours	Max. Marks 75
1. Taxonomy	10
2. Anatomy	5
3. Morphology	4
4. Embryology	5
5. Genetics	10
6. Molecular Biology	4
7. Biotechnology	3
8. Plant Breeding	2
9. Biometry	4
10. Spot (6) three-Paper-V three-Paper-VI	12
11. Viva-voce	8
12. Records	5
13. Excursion Report	3
Total	75

.II Practical (Paper-VIIa and VIIIA)

Time 5 hours	Max. Marks 75
1. Major Exercise	20
2. Minor Exercise	7
3. Spot(5)	15
4. Viva-voce	8
5. Records	5
6. Project Report /Dessertation	20
Total	75

II Practical (Paper-VIIb and VIIIb)

Time 5 hours

Max. Marks 75

1.Plant Community Study	10
2.Soil/Water Analysis(Physical/Chemical Characters)	5
3.Phytogeographycal Regions(World/India/Rajasthan)	6
4.Morphological and Anatomical Adaptation	6
5.Spot(5)	15
6. Viva-voce	8
7.Records	5
8.Project Report /Dessertation	20
Total	75

II Practical (Paper-VIIc and VIIIc)

Time 5 hours

Max. Marks 75

1.Major Exercise	20
2.Minor Exercise	7
3.Spot(5)	15
4. Viva-voce	8
5.Records	5
6.Project Report /Dessertation	20
Total	75